

CLAIMS

WHAT IS CLAIMED IS

- 1 1. A flow measuring apparatus comprising:
 - 2 a) a metering reservoir, the metering reservoir having a volume, a reservoir inlet
 - 3 port, a reservoir outlet port, a top and a bottom;
 - 4 b) a control valve, the control valve capable of allowing or stopping liquid from
 - 5 entering the metering reservoir;
 - 6 c) a liquid level sensor, the liquid level sensor located so as to able to sense a
 - 7 fluid level within the metering reservoir and operably connected to an upper limit switch and a lower
 - 8 limit switch, the upper limit switch having an upper set point and the lower limit switch having a
 - 9 lower set point; and
 - 10 d) an electronics module, the electronics module in electrical communication
 - 11 with the upper limit switch and the lower limit switch and further in electrical communication with
 - 12 the control valve.
- 1 2. The flow measuring apparatus of claim 1 wherein the upper set point is
- 2 located at the top of the metering reservoir.
- 1 3. The flow measuring apparatus of claim 1 wherein the lower set point is
- 2 located at the bottom of the metering reservoir.
- 1 4. The flow measuring apparatus of claim 1 wherein the liquid level sensor
- 2 comprises a float.
- 1 5. The flow measuring apparatus of claim 4 wherein the liquid level sensor
- 2 further comprises a vertical guide, the vertical guide attached to the top of the metering reservoir and
- 3 the bottom of the metering reservoir, and further wherein the float is capable of transversing the
- 4 guide vertically.

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1 6. The flow measuring apparatus of claim 1 wherein the reservoir inlet port is
2 located at the top of the metering reservoir.

1 7. The flow measuring apparatus of claim 1 wherein the reservoir inlet port is
2 located at the bottom of the metering reservoir.

1 8. The flow measuring apparatus of claim 1 wherein the volume of the metering
2 reservoir between the upper set point and the lower set point has an error tolerance of less than 1%.

1 9. The flow measuring apparatus of claim 8 wherein the volume of the metering
2 reservoir between the upper set point and the lower set point has an error tolerance of less than
3 0.1%.

1 10. The flow measuring apparatus of claim 1 wherein the metering reservoir
2 volume is less than one gallon.

1 11. The flow measuring apparatus of claim 10 wherein the metering reservoir
2 volume is less than one quart.

1 12. The flow measuring apparatus of claim 1 wherein the metering reservoir is
2 rectangular or cylindrical.

1 13. The flow measuring apparatus of claim 1 wherein the metering reservoir
2 further comprises a breather vent, the breather vent located on the top of the metering reservoir.

1 14. The flow measuring apparatus of claim 1 further comprising a power supply,
2 the power supply capable of supplying power to the electronics module.

1 15. The flow measuring apparatus of claim 14 wherein the power supply
2 comprises a battery, a solar panel, or current converted to a 12-volt dc power level.

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~~pump capable of removing fluid from the metering reservoir through the metering reservoir outlet port.~~

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1 17. A flow measuring apparatus comprising:

2 a) a metering reservoir, the metering reservoir having a volume, a reservoir inlet
3 port, a reservoir outlet port, a top and a bottom;

4 b) a tank outlet conduit, the tank outlet conduit capable of conducting fluid to
5 the reservoir inlet port;

6 c) a control valve, the control valve capable of allowing or stopping liquid from
7 flowing from entering the metering reservoir;

8 d) a liquid level sensor, the liquid level sensor located so as to able to sense a
9 fluid level within the metering reservoir and operably connected to a lower switch, the lower limit
10 switch having a lower set point;

11 e) a paddlewheel, the paddlewheel having a central pivot point and paddles, the
12 paddles radiating from the central pivot point, the paddles capable of rotating about the central pivot
13 point, the paddlewheel located within the tank outlet conduit and capable of rotating in response to
14 fluid flow through the tank outlet conduit; and **B**

15 f) an electronics module, the electronics module in electrical communication
16 with the paddlewheel and the lower limit switch and further in electrical communication with the
17 control valve.

18. The flow measuring apparatus of claim 17 wherein the lower set point is
2 located at the bottom of the metering reservoir.

19. The flow measuring apparatus of claim 17 wherein the liquid level sensor
2 comprises a float.

20. The flow measuring apparatus of claim 19 wherein the liquid level sensor
2 further comprises a vertical guide, the vertical guide attached to the top of the metering reservoir and
3 the bottom of the metering reservoir, and further wherein the float is capable of transversing the
4 guide vertically.

21. The flow measuring apparatus of claim 17 wherein the reservoir inlet port is
2 located at the top of the metering reservoir.

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1 22. The flow measuring apparatus of claim 17 wherein the reservoir inlet port is
2 located at the bottom of the metering reservoir.

1 23. The flow measuring apparatus of claim 17 wherein the volume of the
2 metering reservoir has an error tolerance of less than 1%.

1 24. The flow measuring apparatus of claim 23 wherein the volume of the
2 metering reservoir has an error tolerance of less than 0.1%.

1 25. The flow measuring apparatus of claim 17 wherein the metering reservoir
2 volume is less than one gallon.

1 26. The flow measuring apparatus of claim 25 wherein the metering reservoir
2 volume is less than one quart.

1 27. The flow measuring apparatus of claim 17 wherein the metering reservoir is
2 rectangular or cylindrical.

1 28. The flow measuring apparatus of claim 17 wherein the metering reservoir
2 further comprises a breather vent, the breather vent located on the top of the metering reservoir.

1 29. The flow measuring apparatus of claim 17 further comprising a power supply,
2 the power supply capable of supplying power to the electronics module.

1 30. The flow measuring apparatus of claim 29 wherein the power supply
2 comprises a battery, a solar panel, or current converted to a 12-volt dc power level.

1 31. The flow measuring apparatus of claim 17 further comprising a pump, the
2 pump capable of removing fluid from the metering reservoir through the metering reservoir outlet
3 port.

1 32. A flow measuring apparatus comprising:

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- 2 a) a holding tank, the holding tank having a height, a bottom, and a holding tank
3 outlet port;
- 4 b) a metering reservoir, the metering reservoir in fluid communication with the
5 holding tank and further having a volume, a reservoir inlet port, a reservoir outlet port, a top and a
6 bottom;
- 7 c) a control valve disposed between the holding tank and the metering reservoir,
8 the control valve capable of allowing or stopping liquid from flowing from the holding tank to the
9 metering reservoir;
- 10 d) a liquid level sensor, the liquid level sensor located so as to able to sense a
11 fluid level within the metering reservoir and operably connected to an upper limit switch and a lower
12 switch, the upper limit switch having an upper set point and the lower limit switch having a lower
13 set point; and
- 14 e) an electronics module, the electronics module in electrical communication
15 with the upper limit switch and the lower limit switch and further in electrical communication with
16 the control valve, the electronics module so configured as to be able to receive notification of
17 activation of the upper limit switch and the lower limit switch, and further configured so as to be
18 able to direct the opening or closing of the control valve and to monitor the activation of the lower
19 limit switch and upper limit switch.

33. The flow measuring apparatus of claim 1 wherein the holding tank outlet port
is located at the bottom of the holding tank.

34. A method of measuring a small volume flow comprising:

- a) providing a flow measuring apparatus, the flow measuring apparatus
comprising a holding tank, the holding tank having a height, a bottom, and a holding tank outlet
port; a metering reservoir, the metering reservoir in fluid communication with the holding tank and
further having a volume, a reservoir inlet port, a reservoir outlet port, a top and a bottom; a control
valve disposed between the holding tank and the metering reservoir, the control valve capable of
allowing or stopping liquid from flowing from the holding tank to the metering reservoir; a liquid
level sensor, the liquid level sensor located so as to able to sense a fluid level within the metering

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9 reservoir and operably connected to an upper limit switch and a lower limit switch, the upper limit
10 switch having an upper set point and the lower limit switch having a lower set point; and an
11 electronics module, the electronics module in electrical communication with the upper limit switch
12 and the lower limit switch and further in electrical communication with the control valve;

13 b) providing a fluid within the holding tank, the fluid in the holding tank having
14 a volume;

15 c) opening the control valve to allow fluid flow between the holding tank and
16 the metering reservoir;

17 d) filling the metering reservoir with the fluid until the upper limit switch is
18 activated;

19 e) closing the control valve to stop fluid flow between the holding tank and the
20 metering reservoir;

21 f) emptying the metering reservoir of fluid until the lower limit switch is
22 activated; and

23 g) measuring the fluid emptied from the metering reservoir.

35. The method of measuring a small volume flow of claim 34 wherein the step
of calculating the fluid emptied from the metering reservoir is accomplished with the electronics
module or separately located monitoring equipment.

36. The method of measuring a small volume of flow of claim 35 further
comprising:

calculating the volume of fluid in the holding tank

37. The method of measuring a small volume flow of claim 34 further
comprising:

powering the electronics module with a battery, a solar panel, or current converted to
a 12-volt dc power level.

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38. The method of measuring a small volume flow of claim 34 further comprising
after step (f):
injecting the fluid into a second fluid.

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